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Title:High-performance terahertz quantum cascade lasers operating at 106 um: Analysis of the thermal and electronic properties
Authors:Vitiello, Miriam S. (1); Scamarcio, Gaetano (1); Spagnolo, Vincenzo (2)
Author affiliation:(1) INFM Regional Laboratory LIT 3, Dipartimento Interateneo di Fisica M. Merlin, University Degli Studi di Bari, Via Amendola 173, 70126 Bari, Italy; (2) INFM Regional Laboratory LIT 3, Dipartimento Interateneo di Fisica M. Merlin, Politecnico di Bari, Via Amendola 173, 70126 Bari, Italy
Corresponding author:Vitiello, M.S.(vitiello@fisica.uniba.it)
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Abstract:We report on the investigation of the electronic and thermal properties of high performance terahertz (THz) quantum cascade lasers (QCLs) based on a bound-to-continuum scheme and grown by molecular beam epitaxy (MBE) by a commercial provider. The local lattice temperatures, the subband electronic temperatures and the electron-lattice coupling constant have been extracted from the analysis of microprobe band-to-band photoluminescence spectra measured on devices operating in continuous wave (cw). We found that the electronic distributions in both the active region and the injector are thermalized and that all the subbands share the same electronic temperatures. The measured device thermal conductance C* = 4.6 W/(K×m) reflects the good thermal management of the investigated devices. The electron-lattice coupling constant α = 78.5 Kcm2/kA is a factor 1.65 higher than in mid-IR QCLs thus indicating the inefficient cooling of the electronic ensemble caused by the strong reduction of electron-LO phonons scattering channels. .
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